Multicast Basics

Multicast clients have the most feature-rich user experience with video conferencing and Exchange Conferencing Server. The following sections provide background information on IP multicast, multicast addresses, Time to Live (TTL) value, multicast groups, multicast scopes, and IP addresses that are reserved for multicast.

IP Multicast

IP multicast is an extension to the IP network layer protocol defined in RFC 1112. It provides an efficient way of transmitting packets on the network from one or more sources to many destinations.

There are three basic modes of transmitting packets over an IP network: unicast, broadcast, and multicast.

In unicast mode, packets are transmitted over a point-to-point connection. If there is more than one recipient for the packet, several point-to-point connections are established and a copy of each packet is sent to each recipient.

In broadcast mode, a single copy of a packet is sent to the entire network, including subnets that don’t have recipients for the packet. Thus, extra traffic is created that consumes valuable network bandwidth.

In multicast mode, a single copy of the data is transmitted to subnets that have a recipient host subscribed to the session. Hosts subscribe to the session by joining a multicast group, which they do by propagating (through Internet Group Management Protocol) a pair of addresses — multicast address and recipient’s IP address — to the routers on the network.

Multicast Address

Class D IP addresses, in the range 224.0.0.0 to 239.255.255.255 are called multicast addresses. Packets sent to an address in this range are not addressed to a specific host. Any host that has knowledge of a specific multicast address can join a multicast group identified by this address. Once a host joins, routers start forwarding all packets that they encounter to the subnet on which the host resides. The host can then pick up the packets being sent to that address. A host can become a member of any number of multicast groups.

Time to Live Value

It is not a good idea to distribute all packets sent to all multicast addresses. Multicast packets have a specific lifetime. The Time to Live (TTL) value identifies the lifetime of these packets. Every time a router is hit in the path of the packets, the TTL value is reduced by one, and if the value is zero, the router does not forward the packets any further. This means that packets with a TTL value of one are distributed on the subnet only. Multicast datagrams with a TTL value greater than one can be delivered to more than one subnet, if there is one or more multicast routers attached to the first subnet.

Multicast Group

An IP multicast group, also known as a host group, is a set of hosts that finds IP traffic destined for a specific multicast IP address. Multicast IP traffic is sent to a single media access control (MAC) address but processed by multiple IP hosts. A given host receives all packets sent to a specific IP multicast address.

Internet Group Management Protocol (IGMP) manages IP multicast groups. The membership of a host group is dynamic. Hosts may join and leave groups at any time. There is no restriction on the location or number of members in a host group. A host may be a member of more than one group at a time.

A host group may be permanent or transient. A permanent group has a well-known, reserved IP address. These addresses are registered with the Internet Assigned Numbers Authority (IANA). (For more information, see “Reserved Addresses,” later in this chapter.) It is the address, not the membership of the group, that is permanent; at any time, a permanent group may have any number of members or no members.

The IP multicast addresses that are not reserved for permanent groups are available for dynamic assignment to transient groups that exist only as long as they have members. Members of a host group can span IP routers across multiple networks. This requires IP multicast support on the IP routers and the ability for hosts to register their group membership with local routers. Host registration is accomplished by using IGMP.

For a host to receive IP multicasts, a client application must inform the local router that the application will be receiving multicasts at a specified IP multicast address. If the network technology supports hardware-based multicasting, then the client application signals the network interface card to pass up packets for a specific multicast address. With Ethernet, the network interface card is programmed to respond to a multicast MAC address corresponding to the desired IP multicast address.

In order to facilitate IP multicast between subnets, the routers must be multicast aware. Routers maintain special routing tables that enable them to decide whether to forward multicast traffic to the specific network or not. Routers propagate routing information and create a router topology, known as a spanning tree, for each multicast session. The spanning tree is constructed so that a single path exists between any pair of participating routers, without any loops.

Multicast Scope

A range of multicast addresses and an associated TTL define a multicast scope. The scopes used for video conferences are retrieved from the scopes defined on the organization’s MADCAP servers. By using scopes in conjunction with configuration of routers, you can limit the reach of multicast packets on the network. You can apply additional restrictions by configuring boundary routers for specific multicast scopes.